MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

TCS1011 – DATA STRUCTURES AND ALGORITHMS

(All groups)

11th March 2017
2:30 PM – 4:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages only (including this page).
2. Attempt **ALL** questions. The distribution of the marks for each question is given.
3. Print all your answers in the Answer Booklet provided.
4. State all assumptions clearly.

Question 1

Give the time complexity in Big-O notation for each of the following functions?

(10m)

a)
```
int f1(int N) {
    int x = 0;
    for (int i = 0; i < N; i++)
        x++;
    return x;
}
```

b)
```
int f2(int N) {
    int x = 0;
    for (int i = 0; i < N; i++)
        for (int j = 0; j < i; j++)
            x++;
    return x;
}
```

c)
```
int f3(int N) {
    if (N == 0) return 1;
        int x = 0;
    for (int i = 0; i < N; i++)
        x += f3(N-1);
    return x;
}
```

d)
```
int f4(int N) {
    if (N == 0) return 1;
        return f6(N-1) + f6(N-1);
}
```

e)
```
int f5(int N) {
    if (N == 1) return 0;
    return 1 + f7(N/2);
}
```

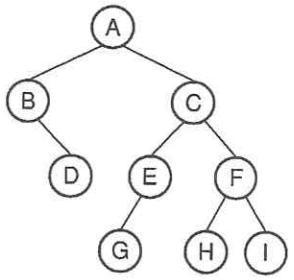
Continued...

Question 2

a) Given an integer n>0, write a C++ recursive function countdown that prints the integers n, n-1, n-2,…, 3, 2, 1.

(4m)

b) What are the preorder, inorder and postorder traversals of the trees below?



(3m)

c) Draw a binary tree to represent the algebraic expression below:
$((a*x + b*y) - c^2)/4$

(3m)

Question 3

a) Write a C++ function that displays only the ith integer in a linked list of integers. Assume that i>= 1 and that the linked list contains at least i nodes.

(5m)

b) The column on the left is the original input of strings to be sorted; the column on the right are the string in sorted order; the other columns are the contents at some intermediate step during one of the 6 sorting algorithms listed below. Match up each algorithm by its number with the corresponding column. Use each number exactly once.

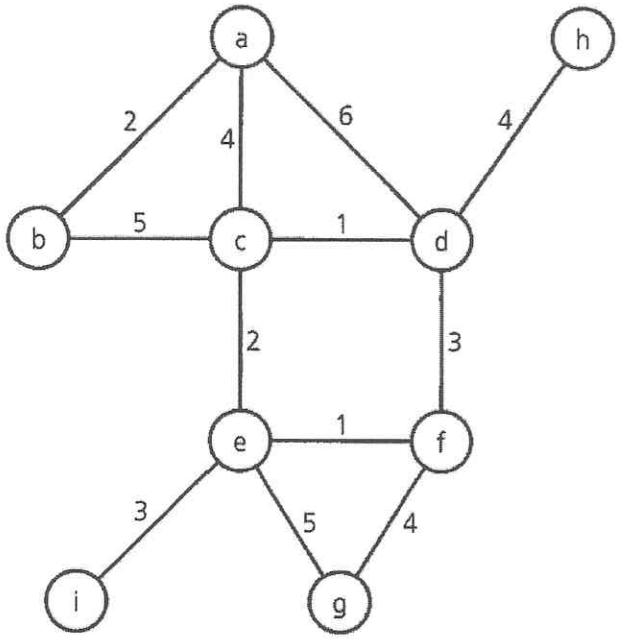
john	aviv	alan	aviv	yort	alan	alan
tzha	azhu	anna	azhu	tzha	andy	andy
fyau	ctai	fyau	ctai	vyas	anna	anna
ctai	ddix	ctai	ddix	ravi	aviv	aviv
nbal	fyau	andy	fyau	sida	azhu	azhu
ddix	john	ddix	john	oleg	azhu	azhu
sguo	kuan	azhu	kuan	sguo	ctai	ctai
azhu	nbal	azhu	nbal	peck	ddix	ddix
aviv	sguo	aviv	oleg	ctai	fyau	fyau
sida	sida	john	sguo	nbal	john	john
kuan	tzha	kuan	sida	kuan	kuan	kuan
vyas	vyas	vyas	tzha	lily	kwak	kwak
oleg	kwak	oleg	vyas	fyau	oleg	levy
levy	levy	levy	levy	levy	levy	lily
kwak	muir	kwak	kwak	kwak	vyas	muir
muir	oleg	muir	muir	muir	muir	nbal
peck	peck	peck	peck	azhu	peck	oleg
ravi	ravi	ravi	ravi	aviv	ravi	peck
alan	alan	sida	alan	alan	sida	ravi
yort	andy	yort	yort	john	yort	sguo
azhu	anna	sguo	azhu	azhu	nbal	sida
andy	azhu	nbal	andy	andy	tzha	tzha
anna	lily	tzha	anna	anna	sguo	vyas
lily	yort	lily	lily	ddix	lily	yort
0						1

0) Original input
1) Sorted
2) Selection sort
3) Insertion sort
4) Mergesort
5) Quicksort
6) Heapsort

Continued...

Question 4

Consider the following graph. Assume the adjacency lists are in sorted order: for example, when iterating through the edges pointing from *a,* consider the edge a→b before a→c or a→d.



a) Use depth-first search (DFS) to traverse the graph, starting from vertex a. What ADT is used to keep track the sequence of visited vertices for DFS?

(5m)

b) Use breadth-first search (BFS) to traverse the graph, starting from vertex a. What ADT is used to keep track the sequence of visited vertices for BFS?

(5m)

End of page